

### **REMARKS**

Claims 1-20 are all the claims pending in the application. Claims 1-4, 6, 7 and 13-20 stand rejected. Claims 5 and 8-12 are objected to but would be allowable if placed into independent form. Claims 5 and 8 have been amended, thereby making claims 5 and 8-12 allowable.

### ***Oath/Declaration***

The Examiner objects to the declaration because the citizenship of inventor Amir Zaghoul is not identified. Mr. Zaghoul's citizenship is U.S.A. A new declaration will be submitted in the near future.

### ***Specification***

The Examiner objects to the abstract because of the term "invention." The abstract has been amended to remove the term.

In addition, a brief description of Fig. 5 has been added to page 1. No new matter is inserted by this addition.

Finally, the specification has been amended consistent with the changes to Fig. 1, as recommended by the Examiner.

### ***Drawings***

The drawings are objectionable because of the use of certain reference numbers in Fig. 1 for the same elements in parallel paths, the numbering and description of Fig. 5 as well as its labeling as "Prior Art", and the line characteristics in Figs. 1 and 5. These Figs. have been amended and are being submitted with this reply.

### ***Claim Rejections – 35 USC 102***

**Claims 1-4, 7, 13 and 16 are rejected under 35 USC 102(e) as being anticipated by Monte et al (6,101,385).** This rejection is traversed for at least the following reasons.

The present invention concerns a method of communicating communication signals from a first type antenna as multiple sub-beams within a bandwidth allocated to a basic spot beam. This concept can apply to terrestrial cellular communication, as well as to satellite communication systems. The dividing of the basic spot beam (or cell) into sub-beams reduces the antenna size and may increase the system capacity.

Monte teaches a communication system in which he designates the entire coverage of the satellite a “beam,” and further designates the individual beams as “sub-beams.” According to the present invention, the individual beam coming from a single antenna is the basic “beam” and that single beam is divided into “sub-beams.” In short, the “sub-beams” in Monte correspond to the basic “beam” in the present invention. Given that difference in definition, it is clear that the present application takes Monte a step beyond its teachings and further divides the “sub-beams” in Monte. On the basis of applicant’s definition in the specification and as clarified herein, Applicant has divided the basic beam (sub-beam in Monte) further into what Applicants call sub-beams for the purpose of reducing the gain difference between the peak value and the gain at the sub-beam edge, thus reducing the antenna aperture size. This further division is not taught by Monte, thereby avoiding anticipation. Moreover, the concept of further division is not obvious to one skilled in the art.

Applicants are prepared to refer to its “sub-beams” as “micro-beams” throughout the disclosure and claims, if the Examiner would find this terminology clearer.

#### **Claims 2 and 3**

These claims define the sub-beam (micro-beam) frequency segments as being within the frequency segment of the basic beam. This is a subdivision of the frequency re-use allocations of the basic beam.

#### **Claim 4**

An objective in the present disclosure is to use a phased array that has a smaller aperture compared with the one that requires large gain variation over the beam, thus a higher peak gain for a specified edge gain. The phased array is defined here in this context.

#### **Claim 7**

This claim defines further the concept of sub-beams (micro-beams) as filling the whole area of the basic beam, thus the contiguous nature of the sub-beams (micro-beams). The way the sub-beams (micro-beams) are structured is to produce the smaller differential between the peak gain and edge gain. This may not be achieved using Monte’s shapes for the sub-beams.

**Claim 13**

The claim would be patentable for reasons given for claim 4.

**Claim 16**

The number of sub-beams in Monte is more or less arbitrary, where the number of basic beams and sub-beams (micro-beams) in the present invention is dictated by the contiguous nature of the basic beams and sub-beams and the frequency re-use structure.

***Claim Rejections – 35 USC 103***

**Claim 6 is rejected under 35 USC 103(a) as being unpatentable over Monte as applied to claim 1 and further in view of Dent (6,377,558).** This rejection is traversed for at least the following reasons.

This claim defines an important principle and advantage of the present invention. In general, sub-beams (micro-beams) have higher gain than the basic beam because of their smaller size or narrower beamwidth, assuming the beamwidths in question are defined at the same dB level to their corresponding peak gain. However, because of the definition of the gain at the beam edge in this case, the situation is different and allows the use of the smaller aperture, which is a significant advantage offered by the present invention. The **sub-beam** edge gain is defined as 1 dB lower than the peak gain, while the **basic beam** edge gain is 3 or 4 dB lower than its peak gain.

If the aim of the cellular coverage is to achieve certain dBi level of gain throughout the cell (sub-beam or basic beam), then the required peak gain of the sub-beam would be 1 dB above that level, while the required peak gain of the basic beam is 3-4 dB above that level. This means that the peak gain of that antenna that produces the sub-beams is less than the peak gain of the antenna that produces the basic beam. This results in the smaller aperture of the antenna.

As Dent teaches, larger apertures produce higher gain, but at the same time they produce narrower beam (sub-beam), while smaller apertures produce broader beams and lower gain. Thus, this claim is clearly different from the cited art.

**Claims 14, 15 and 17-19 are rejected under 35 USC 103(a) as being unpatentable over Monte as applied to claim 1 and further in view of Eguchi (5,594,460).** This rejection is traversed for at least the following reasons.

**Claims 14-15**

As explained in the discussion of claim 6, the gain drops for the basic beam and the sub-beams are at the heart of the advantage achieved by the present invention in reducing the antenna aperture. The gain drop is the difference between the peak gain of the beam and the lowest gain at any point within the beam, mostly the edge of the beam.

Monte is silent about the gain drop because it is irrelevant to the disclosed design.

Eguchi uses the standard definition of the antenna beamwidth as the angles within which the antenna gain drops by 3 dB. Eguchi further comments on the drop in the peak gain by 1 dB as the peak point moves within  $\pm 25$  degrees. The 1 dB is a drop in the antenna peak gain and not in the gain of points within the beam. The 1 dB drop in the beam peak gain is considered a loss and is not a character of the gain drop within the beam. This is totally different from the present invention, and indeed, the present invention does not have to consider the difference between the peak gains of the different beams.

**Claim 17**

This claim is patentable for the same reasons given for claims 6, 14 and 15.

**Claims 18 and 19**

These claims are intended to define the application of the invention to satellite systems. Also as explained with regard to Claim 13, the claim would be patentable for reasons given for the parent claim.

**Claim 20 is rejected under 35 USC 103(a) as being unpatentable over Monte as applied to claim 1 and further in view of Norin (6,434,384).** This rejection is traversed for at least the following reasons.

The emphasis in this claim is on the small difference between the peak gain and the edge gain, or the small differential in the gain. This is to define the advantage of using a smaller aperture in comparison with a larger aperture when the gain differential is large, provided that the required edge gain is the same. The small differential in Norin is to provide

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higher power to serve higher capacity in certain areas, and is not to reduce the antenna aperture as is the focus of the present invention.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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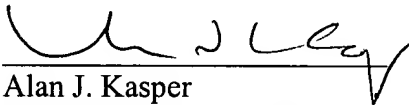
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